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KENNETH E. HORTON
RADER, FISHMAN & GRAUER PLLC
RIVERPARK CORPORATE CENTER ONE
10653 SOUTH RIVERFRONT PARKWAY, SUITE 150
SOUTH JORDAN, UT 84095

EXAMINER

MALDONADO, JULIO J

ART UNIT PAPER NUMBER

2823

DATE MAILED: 05/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/843,023

Applicant(s)

LOSEE, BECKY

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 and 52-57 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 and 52-57 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 11 March 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Applicant's addition to claims 52-57 is acknowledged.
2. The objections to the drawings and the specification are withdrawn in view of applicants' amendments.
3. Claims 1-24 and 52-57 are pending in the application.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 4-7, 10 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Shoji et al. (U.S. 5,928,965).

In reference to claims 4 and 22, Shoji et al. (Figs.1a-1c) in a related method to form a trench in a semiconductor substrate teach the steps of providing a silicon layer (101); providing a patterned mask (102, 103, 104, 105) over the silicon layer (101); etching the silicon layer (101) with a uniform plasma gas comprising a chlorine-containing gas, a passivating gas, a selectivity gas, and a diluent gas; and removing the patterned gas (102, 103, 104, 105) (column 3, line 40 – column 4, line 12).

In reference to claims 5-7 and 10, Shoji et al. teach the chlorine containing gas comprising Cl₂; the passivating gas comprising HBr; the selectivity gas comprising O₂; and wherein the etching is performed in a single step (column 3, line 40 – column 4, line 12).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-3, 8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji et al. ('965) in view of Yi (U.S. 5,900,163).

Shoji et al. (Figs. 1a-1c) in a related method to form a trench in a semiconductor substrate teach the steps of providing a silicon layer (101); providing a patterned mask (102, 103, 104, 105) over the silicon layer (101); etching the silicon layer (101) with a uniform plasma gas comprising a Cl₂, HBr, O₂, and a He; and removing the patterned gas (102, 103, 104, 105) (column 3, line 40 – column 4, line 12).

Shoji et al. fails to teach etching the substrate using argon instead of helium. However, Yi et al. in a related method to form trenches in a semiconductor substrate teach that inert gases such as helium and argon can be used to etch tapered semiconductor substrates (column 1, lines 40-59). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use either helium or argon as taught by Yi et al. in the trench fabrication method of Shoji et al., since both gases can be used as carrier gases and can also aid in etching by physical sputtering (column 1, lines 49-53).

In reference to claims 2 and 3, Shoji et al. in combination with Yi et al. substantially teach all aspects of the invention but fail to show the deep trench having a

depth ranging from about 1.25 microns to about 20 microns. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

8. Claims 9, 11-19, 23, 24 and 52-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji et al. ('965) in view of Miller et al. (column 6,218,309).

Shoji et al. (Figs.1a-1c) in a related method to form a trench in a semiconductor substrate teach the steps of providing a silicon layer (101); providing a patterned mask (102, 103, 104, 105) over the silicon layer (101); etching the silicon layer (101) with a uniform plasma gas comprising a chlorine-containing gas, a passivating gas, a selectivity gas, and a diluent gas; and removing the patterned gas (102, 103, 104, 105) (column 3, line 40 – column 4, line 12).

Shoji et al. fails to teach forming a plurality of trenches in the silicon layer having a depth uniformity of less than about 2%. However, Miller et al. (Figs.1a-1c) in a related method to form a plurality of trenches teach forming trenches having a depth uniformity of 2% or less (column 11, lines 3-5). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form a plurality of trenches having a depth uniformity of 2% or less as taught by Miller et al. in the trench formation method of Shoji et al., since this improves surface level of the device and its yield (column 2, lines 43-55).

Shoji et al. in combination in Miller et al. fails to teach having a sidewall angle uniformity of less than about 0.5%, 0.15% or 0.1%; the variance in trench depth is less than about 50-500 Å; the sidewall angle is about 89°; and the depth ranges varying from about 1.25 to about 20 microns. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shoji et al. ('965), Yi et al. ('163) and Miller et al. ('309).

Shoji et al. (Figs.1a-1c) in a related method to form a trench in a semiconductor substrate teach the steps of providing a silicon layer (101); providing a patterned mask (102, 103, 104, 105) over the silicon layer (101); etching the silicon layer (101) with a uniform plasma gas comprising a Cl₂, HBr, O₂, and a He; and removing the patterned gas (102, 103, 104, 105) (column 3, line 40 – column 4, line 12).

Shoji et al. fails to teach etching the substrate using argon instead of helium. However, Yi et al. in a related method to form trenches in a semiconductor substrate teach that inert gases such as helium and argon can be used to etch tapered semiconductor substrates (column 1, lines 40-59). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use either helium or argon as taught by Yi et al. in the trench fabrication method of Shoji et

al., since both gases can be used as carrier gases and can also aid in etching by physical sputtering (column 1, lines 49-53).

Shoji et al. in combination with Yi et al. fail to teach forming a plurality of trenches in the silicon layer having a depth uniformity of less than about 2%. However, Miller et al. (Figs. 1a-1c) in a related method to form a plurality of trenches teach forming trenches having a depth ranging from about 1.5 to about 25 microns (column 15, lines 50-67) and a depth uniformity of 2% or less (column 11, lines 3-5). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form a plurality of trenches having a depth of about 1.5 to 25 microns and a depth uniformity of 2% or less as taught by Miller et al. in the trench formation method of Shoji et al. and Yi et al., since this improves surface level of the device and its yield (column 2, lines 43-55).

Response to Arguments

10. Applicant's arguments filed 03/11/2003 have been fully considered but they are not persuasive.

Applicants argue that Shoji et al. describes a process for forming v-shaped grooves, not deep trenches as claimed. In response to applicant's arguments, the recitation deep trench has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re*

Hirao, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). Furthermore, the grooves taught by Shoji et al. are indeed deep trenches as claimed.

Also, applicants argue, "...the office, however, has not substantiated that the depth of the trench is a result-effective variable...". In response to this argument, the depth of the trench depends on the desired device density, degree of isolation device dimensions, and therefore device properties on the finished wafer.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November


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1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.


JMR
5/13/03


George Fourson
Primary Examiner